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The Predictive Power of Capital Adequacy Ratios on Bank Risk

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Abstract

Risk management is a main issue on accounting research recently. This study investigates whether capital adequacy ratios (Basel regulatory capital ratio under 1998 version and traditional capital ratio on the balance sheet) can predict subsequent bank risk, and whether the regulatory risk-based capital ratio is more useful as a warning indicator for bank solvency than the traditional capital ratio in Taiwan. Considering characteristics of banking industry, this study employs an option pricing methodology to obtain implied asset risk as a market-based proxy for a bank's total risk. Empirical results indicate that both capital ratios are negatively associated with subsequent bank risk, and that the regulatory risk-based capital ratio more completely predicts bank risk than the traditional capital ratio does. In other words, the urging warning function of the risk-based capital requirement on bank risk is effective.

Key Words: Bank risk, Basel, Option pricing methodology, Risk-based capital ratio, Solvency

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資本適足比率對銀行風險之預警能力

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摘要

風險管理為近期會計研究的主要議題之一。本文旨在探討 1998 年巴塞爾協定所規定之資本適足率及財務報表分析經常使用之資本比率是否具有預測銀行風險的能力。另外，亦探討以風險為基礎之資本適足率相較於傳統之資本比率是否更具有預警價值。文中考慮銀行業之特性，以選擇權評價模型計算出隱含資產風險，用以衡量銀行總風險。實證結果發現：本期資本比率皆具有預測銀行風險的能力，為評估銀行清償能力之攸關指標，與下期銀行風險呈顯著負相關，亦即本期資本比率愈低的銀行，傾向下期承作較多高風險的業務。另外，資本適足率相較於傳統財報分析使用之資本比率具有更強的預測能力，顯示此項金融管制措施在偵測銀行風險上具有預警效力。

關鍵詞：銀行風險、巴塞爾、選擇權評價模型、資本適足率、清償力

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1. Backgrounds and Introduction

The importance of risk measurement and management to modern bank should not be under valuated. The failure of a single bank may induce a domino effect; moreover, regional financial crisis may occur because international capital has moved rapidly due to the globalization and liberalization of financial markets. Thus, developing a timely and dynamic risk-relevant disclosure system to promote economy safety and enhance transparency is an urgent mission for bank supervisors and accounting profession.

Before 1988, capital requirements in the different countries were not comparable because different elements were considered to be bank capital and assets. The traditional solvency measure is the ratio of capital to total assets on the balance sheet, and its drawback is that it does not include any risk adjustment. Since the Basel Committee on Banking Supervision set an accord for assessing bank capital adequacy in 1988, it has become the standard for financial regulation throughout the world. The major goal of this risk-based capital requirement is intended to reduce moral hazard problems that arise from the provision of deposit insurance and other guarantees by government (Berger et al., 1995; Santos, 2000) and to minimize competitive inequality that arises from differences among national bank-capital regulations (Wagster, 1996).

The Committee issued the modification in 1996, which incorporated the market risks in assessment of regulatory capital for trading positions that was ignored by the old 1988 version. The different elements between the traditional capital ratio and the 1996 Basel's risk-based capital ratio are discussed as follows. Traditional capital consists of common stock, paid-in capital, retained earnings, and preferred stock. The denominator of the traditional capital ratio is the sum of the total book assets.[1] The Basel

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[1] Before Basel accord, US banks had to maintain primary capital (or total capital) equal to at least 5.5% (6%) of gross assets. Primary capital includes all components of the book capital plus mandatory convertible debt and loan loss reserves. Gross assets are the sum of the total book assets plus loan loss and operation reserves.

accord changed the computation of the solvency measure and required banks to maintain the total regulatory capital must be equal to at least 8% of risk-weighted assets. The 1996 version divided total regulatory capital into tier 1, tier 2, and tier 3. The Taiwanese version of the 1996 Basel modification was issued in May 1998. In Taiwan regulatory practice, tier 1 capital includes common stock, non-cumulative perpetual preferred stock, capital received in advance, paid-in capital (excluding appraisal surplus of fixed assets), legal surplus, special surplus, retained earnings, minority interest in equity accounts of subsidiaries, and equity adjustment less goodwill. Tier 2 capital is defined as the sum of perpetual preferred stock, appraisal surplus of fixed assets, 45% of unrealized capital gain from long-term equity investment, hybrid capital instruments (mandatory convertible debt), and loan loss reserves (up to a maximum of 1.25% of risk-weighted assets). Tier 3 capital is defined as the sum of issued subordinated short-term bonds and unrealized gain on trading securities.[2] In addition, there are several constraints in regulatory capital allocation. First, tier 1 capital must exceed 4% as a contribution to total capital. Second, long-term subordinated bonds are ruled as part of tier 2 capital but these capital instruments cannot exceed 50% of tier 1 capital, and the specific loss reserves, which are referred to the reserves for inferior loan assets, are excluded from tier 2 capital.[3] Third, tier 3 capital is used only against market risk, where the sum of capital tier 2 and tier 3 against market risk cannot exceed 2.5 times of tier 1 against market risk. Final, the shareholdings of other financial institutions excess one year are ruled to deduct from the numerator and denominator of the capital ratio under the new version.[4]

With respect to the asset side, the traditional equally-risk-weighted capital ratio made no distinction with different levels of asset risk and did

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[2] Unrealized gain on trading securities is not included in tier 3 capital from 2002.

[3] In current practice, loan assets can be classified into four categories according to their quality. The specific loss reserves are defined as the sum of 50% of the third category (difficultly collectible loans) and 100% of the fourth category (uncollectible loans).

[4] This way prevents the double-gearing phenomenon that is artificial infusion of bank capital through cross-shareholding.

not incorporate off-balance sheet activities. The risk-based capital ratio, in contrast, required that different minimum capital percentages would be held against different categories of on- and off-balance sheet assets according to perceived risk weights. However, the usefulness of the Basel accord depends upon how the solvency measure is associated with the actual risk involved. If the correspondence between risk weights and actual risk is weak, or if there are significant activities with higher risk categories assigned lower risk weights, then banks may have compelling incentives to raise asset risk, thereby possibly increasing their insolvency. In other words, when the solvency measure is weakly associated with bank actual risk, it means a regulatory failure.

Given the importance on evaluating the usefulness of the Basel's regulations, most related studies deriving on theoretical models to examine whether risk-based capital requirements may increase or decrease bank insolvency risk (Koehn and Santomero, 1980; Kim and Santomero, 1988; Furlong and Keeley, 1989; Keeley and Furlong, 1990; Dewatripont and Tirole, 1995; Blum, 1999). There has been little empirical study evaluating the effectiveness of this regulation, perhaps due to regulatory data not publicly available. Bradley et al. (1991) document that the 1988 Basel accord was too little to cover insurance cost over the 1985-1988 and that the risk weights assigned to some asset categories would have been mislead. Avery and Berger (1991) find that bank performance is associated with the risk weights of the 1988 Basel accord and that both capital requirements (1988 Basel accord and primary capital requirement) provide incremental information on predicting bank performance in some settings. Sheldon (1996) investigates the impact of the 1988 Basel accord on bank asset risk using data from G10 countries and finds that bank asset risk in US banks rose and that this was the case both for banks which increased their capital ratios and those which did not. In Japan, asset risk fell although most banks raised their capital ratios.

All previous studies investigated the effect or impact of the 1988 Basel accord on bank behavior, there has been little empirical work to evaluate policy usefulness of the risk-based capital ratio (based on 1996 modification) relative to the traditional capital ratio (based on financial statement) in examining and predicting bank risk. This study attempts to fill these gaps using a sample from Taiwan. Main tests include (1) whether capital ratios (as solvency measures) can help supervisors, depositors, and investors predict subsequent bank risk, and (2) whether the 1998 regulatory risk-based capital ratio is more powerful as an indicator of bank solvency than the traditional capital ratio only based on balance sheet. Overall, the empirical results contribute to capturing the regulatory effectiveness on the urging warning function in an emerging market economy.

The remainder of this study is organized as follows. Section 2 presents the market-based risk measurement for banking industry. Section 3 presents the research design. Section 4 describes the sample and reports empirical results and Section 5 concludes.

2. Market-Based Risk Measurement for Banking

Bank supervisors are primarily concerned with total risk of a bank because there is no option for diversification across different industries. The deposit insurance agency cannot short-sell risky bank stock, it cannot refuse to insure any given bank, and it cannot hold other industrial stock. Since both stockholders and supervisors bear bank risk when such institutions fail, Hassan (1993) and Hassan et al. (1994) contend that it is inappropriate to employ the equity risk as a proxy for total risk for regulated banking industry in previous literature. Given the contingent claims nature of equity and deposit insurance, Ronn and Verma (1986, 1989, hereafter RV) apply the option pricing model by Black and Scholes (1973) to measure the underlying standard deviation of a bank's assets. They demonstrate that the empirical estimation of risk and deposit insurance premium is tractable when time-series data on the market value of bank equity and the book value of debt are available. Their approach incorporates the non-linearity of an option pricing model, deposit insurance, and regulatory closure rules. Literatures using RV approach to measure bank risk include Hassan (1993), Hassan et al. (1994), Ahmed et al. (1999), and Episcopos (2004). This study examines the predictive power of capital adequacy ratios on bank risk from an information perspective. To arrive at a measure of the unobservable asset risk using the observable standard deviation of stock returns, I adopt this market-based bank risk measurement.

The following framework is RV option-pricing model recognizing that the bank's equity is a call option on the value of the bank with a strike price equal to the face value of debt.

$$E = VN(x) - \rho BN(x - \sigma_V \sqrt{T}) \tag{1}$$

$$x = \frac{\ln(V/\rho B) + \sigma_V^2 T/2}{\sigma_V \sqrt{T}}$$

$$\sigma_V = \sigma_E \frac{E}{VN(x)} \tag{2}$$

where N(·) denotes the cumulative density of a standard normal random variable, B presents the total debt of the bank, E is the market price of equity, V is the value of the assets, σ_E is the instantaneous volatility of the equity return,[5] σ_V is the asset volatility (or implied asset risk), T is the time until the next audit of bank assets, and ρ represents a policy parameter and is accordingly difficult to estimate empirically because its value depends on the nature and scope of disruption, past history of bank failure, and the economic conditions at the time the supervisors is confronted with the closure decision (Pyle, 1984).

The Taiwanese version of the 1996 Basel modification was issued in May 1998, and all banks were required to file the regulatory capital adequacy information to the Bureau of Monetary Affairs, Ministry of Finance semiannually from December 31, 1998. Thus, in this context, it is essential assumed that stockholders and supervisors perceive T to be equal

[5] This study calculates the standard deviation of the bank equity return (σ_E) as another proxy for total risk for the robustness check.

to 1/2 year, and it is reasonable to assume $\rho = 1$ (i.e., the deposit insurance agencies liquidate a bank when its net worth is observed negative).[6] Equations (1) and (2) can be solved simultaneously for the pair (V, σ_V) by a numerical routine given each observed B, E, σ_E, T, and ρ.[7]

3. Research Design

3.1 Predictive Power of Solvency Measures

Hamada (1969) and Bowman (1979) have demonstrated that the systematic risk of a firm is positively correlated with the firm's leverage. Several empirical findings are generally consistent with the capital structure theory (Beaver et al., 1970; Hamada, 1972; Gonedes, 1973; Beaver and Manegold, 1975; Bowman, 1980; Christie, 1982; Karels et al., 1989). Based on the theoretical relationship, the Basel accord link a bank's risk-taking and its equity level to prevent moral hazard behavior because that the capital structure of a bank represents a succinct picture of a bank's solvency.

Several other variables influenced bank risk must be controlled in empirical settings based on prior research and institutional features peculiar to the banking industry. Here discuss in brief. First, since Flannery and James (1984) constructed the gap between short-term nominal assets and liabilities as a measure of maturity mismatch, several banking research has also used the similar measure to proxy the interest rate risk (Avery and Berger, 1991; Beaver et al., 1989; Barth et al., 1991;

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[6] Ronn and Verma (1986) show that a ρ of 0.97 yielded a weighted average deposit premium of about 1/12 percent, the flat rate premium over the data period in their study. Hassan (1993) and Hassan et al. (1994) set the value of ρ at 1.

[7] The following equation is the polynomial approximation to the normal distribution (Cox and Rubinstein, 1985).

$$N(z) = 1 - \frac{1}{\sqrt{2\pi}}[\exp(-z^2/2)](a_1 k + a_2 k^2 + a_3 k^3 + a_4 k^4 + a_5 k^5) \quad \text{for} \quad z > 0$$

where

$$k = \frac{1}{1 + pz}$$

$p=0.2316419$; $a_1=0.31938153$; $a_2=-0.356563782$;
$a_3=1.781477937$; $a_4=-1.821255978$; $a_5=1.330274429$

Hassan, 1993; Hassan et al., 1994). The greater the absolute value of GAP, the more the bank is exposed to the interest rate risk. Second, non-performing loans reflect asset quality in the loan portfolio and default risk of the bank. Banks with higher proportion of bad debts to loans may be exposed to higher credit risk (Beaver et al., 1989; Hassan, 1993; Hassan et al., 1994; Venkatachalam, 1996). Therefore, this study expects NPL to be positively associated with bank risk. Third, some empirical evidence has shown the significantly positive effect of growth on the firm's systematic risk (Beaver et al., 1970; Beaver and Manegold, 1975). Beaver et al. (1970) argue that an above normal growth originates from excessive earnings opportunities, excessive ex post return, and a higher retention of earnings. It is intuitively appealing to think that the more asset expansion may cause the more uncertainty of earnings stream. Therefore, this study expects growth to be positively associated with bank risk. Final, it is widely documented that larger firms are less risky than smaller firms. Empirical evidence has generally found that there is a negative association between systematic risk and monopoly power/size of a firm (Beaver et al, 1970; Beaver and Manegold, 1975; Avery and Berger, 1991; Hassan, 1993; and Hassan et al., 1994). To evaluate the predictive power of capital ratios on bank risk, the following empirical specification is estimated. If capital ratios are useful in predicting subsequent bank risk, then α_1 and β_1 will be significant.

$$RISK_{i,t+1} = \alpha_0 + \alpha_1 RBCR_{it} + \alpha_2 GAP_{it} + \alpha_3 NPL_{it} + \alpha_4 GROW_{it} + \alpha_5 SIZE_{it} + \varepsilon_{it} \quad (3)$$

$$RISK_{i,t+1} = \beta_0 + \beta_1 TCR_{it} + \beta_2 GAP_{it} + \beta_3 NPL_{it} + \beta_4 GROW_{it} + \beta_5 SIZE_{it} + \xi_{it} \quad (4)$$

where

$RISK_{i,t+1}$ = (1) the implied asset risk (σ_V) derived from Ronn-Verma option pricing methodology for bank i during semi-year t+1,

(2) the standard deviation of equity return (σ_E) for bank i during semi-year t+1, where $\sigma_E = \sqrt{\sum_{t=1}^{N}(R_t - \overline{R})^2}$, R_t presents the daily return and N is trading days during the semi-year.

$RBCR_{it}$ = the risk-based capital ratio of bank i at the end of semi-year t,

TCR_{it} = the traditional equally-risk-weighted capital ratio (i.e., total equity/total assets on the balance sheet) of bank i at the end of semi-year t,

GAP_{it} = the absolute value of the difference between interest-sensitive assets and liabilities deflated by total assets at the end of semi-year t, where interest-sensitive assets and liabilities are those scheduled to be repriced or mature within one year for bank i at the end of semi-year t,

NPL_{it} = the ratio of non-performing loans to total loans for bank i at the end of semi-year t,

$GROW_{it}$ = the growth rate of total assets for bank i during semi-year t,

$SIZE_{it}$ = the natural logarithm of total assets for bank i at the end of semi-year t,

ε_{it}, ξ_{it} = error terms

3.2 Comparison of Alternative Solvency Measures

The early regulation practice in US used the primary capital ratio as a solvency measure, irrespective of risk of the various assets and off-balance sheet activities. If the Basel accord is more effective on the urging warning function, it is reasonable to hypothesize that the risk-weighted capital ratio should be stricter than the traditional equally-risk-weighted capital ratio in predicting the bank risk. On the other hand, critics have still charged that the credit risk weights and the standardized approach to market risk in Basel accord were somewhat arbitrarily chosen and may not necessarily reflect the true risk inherent in different activities. The debate can be solved by an empirical study to determine which solvency measure is more useful in predicting bank risk.

This study applies the likelihood ratio test proposed by Vuong (1989) to compare the adjusted R^2 for two alternative regressions. The test statistic compares the sum of squared residuals from two competing models (3) and (4) that have the same dependent variable and it has a unit normal distribution under the null hypothesis of equal information content. An advantage of Vuong's approach is that it is derived successively for the cases where the competing models are nonnested, overlapping, or nested.

4. Empirical Results

4.1 Sample Selection and Descriptive Statistics

The sample for this study consists of 30 commercial banks and 2 investment banks listed in Taiwan Securities Exchange, and 3 commercial banks listed in Over-the-Counter Securities Exchange. All banks are required to file regulatory reports to the financial authority semiannually from December 31, 1998. Regulatory data and other public variables are obtained from the Central Bank and Taiwan Economic Journal (TEJ) respectively. The sample period is from December 31, 1998 to December 31, 2002. I yielded 235 bank-time observations after excluding ten incomplete observations. Table 1 presents descriptive statistics. The mean risk-based capital ratio (equally-risk-weighted capital ratio) is 12.814% (9.237%), and the maximum value 71.210% (66.804%) comes from an investment bank (this sample point may be a potential outlier).[8] In panel B, the Pearson correlation between two risk measures of 0.532 is highly positive; this indicates that the results will be highly robust to different measures. The positive correlation between two capital ratios indicates both measures behave, in part, like each other. In addition, both capital ratios are negatively correlated with subsequent bank risk.

[8] The empirical findings of excluding potential outliers yields consistent inferences those reported in the text.

Table 1 Descriptive Statistics and Correlation Matrix

Panel A: Descriptive statistics

Variable #	Mean	Median	Min.	Q 1	Q 3	Max.	Std.
σ_V	1.136	1.047	0.223	0.634	1.607	2.541	0.587
σ_E	2.607	2.712	1.444	2.407	2.997	4.481	0.563
RBCR(%)	12.814	10.933	4.652	9.451	13.529	71.210	7.003
TCR(%)	9.237	8.112	2.762	6.785	9.487	66.804	8.571
GAP(%)	17.012	17.549	2.462	11.830	19.879	41.875	6.923
NPL(%)	5.262	3.875	0.700	2.573	6.050	30.250	4.002
GROW(%)	3.641	2.998	-11.073	-0.104	6.437	41.454	6.731
SIZE	19.216	19.004	17.175	18.940	20.014	20.879	0.756

Panel B: Pearson Correlation matrix

	$\sigma_{E,\ t+1}$	$RBCR_t$	TCR_t	GAP_t	NPL_t	$GROW_t$	$SIZE_t$
$\sigma_{V,\ t+1}$	0.532***	-0.154**	-0.117*	0.006	0.191***	-0.037	0.040
$\sigma_{E,\ t+1}$		-0.115*	-0.103*	0.002	0.235***	-0.082	-0.025
$RBCR_t$			0.518***	0.109*	-0.088	0.176***	-0.159**
TCR_t				0.067	-0.174***	0.340***	-0.213***
GAP_t					0.058	0.047	-0.115*
NPL_t						-0.358***	-0.306***
$GROW_t$							0.027

Variable definitions are as follows:

σ_V = implied asset risk (RV option pricing methodology).
σ_E = standard deviation of bank equity return.
RBCR = risk-based capital ratio under the 1998 Basel version.
TCR = total equity / total assets.
GAP = ratio of the difference between interest-sensitive assets and liabilities to total assets.
NPL = ratio of non-performing loans to total loans.
GROW = growth rate of total assets.
SIZE = natural logarithm of total assets.

Asterisks indicate significant at 1% (***), 5% (**), and 10% (*) levels for two-tailed tests.

4.2 Empirical Results

Table 2 presents estimation results for regression equations (3) and (4). Reported t-statistics are based on White's (1980) heteroskedasticity consistent covariance estimator. The F-statistics testing joint significance of all variables reject the null that their coefficients are equal to zero at 1% level for all models. In panel A, the coefficients on RBCR and TCR in the setting of subsequent implied asset risk ($\sigma_{V,\ t+1}$) are negative and statistically significant at 1% level. In panel B, the coefficients on both capital ratios in the setting of subsequent equity return risk ($\sigma_{E,\ t+1}$) are also negative and statistically significant at 5% level. These results mean that undercapitalized banks intend to take more risk in next period. To compare the adjusted R^2 for regression equations (3) and (4), the results in panel A and B indicate that the adjusted R^2 for the risk-based capital ratio exceeds that for the equally-risk-weighted capital ratio. However, we cannot conclude that the predictive power ranking of RBCR > TCR without further statistical tests. With respect to the control variables related to bank risk, the coefficient on NPL is significantly positive in both risk measures. The significance of NPL coefficient implies, among other things, that nonperforming loans reflect information about economic impairment of loans relating to default risk (i.e., NPL captures part of credit risk.) The coefficients on GAP, GROW, and SIZE are not significantly different from zero, except for that on SIZE in the σ_V setting.

Table 3 summarizes the results of Vuong's statistic for assessing which capital ratio is more powerful in predicting bank risk. The results reveal a ranking of RBCR > TCR and suggest that the risk-based capital ratio provides greater information than the traditional capital ratio in predicting subsequent bank risk.

Table 2 Summary Statistics for Regression Equations (3) and (4)

Panel A: RISK ($\sigma_{V,\,t+1}$)

		Regression (3)		Regression (4)	
Variable	Pred. sign	Coefficient	t-value	Coefficient	t-value
Intercept	non	-3.756	-1.878**	-3.816	-1.791**
$RBCR_t$	–	-0.059	-3.105***		
TCR_t	–			-0.036	-2.685***
GAP_t	+	-0.078	-0.673	-0.033	-0.089
NPL_t	+	0.024	1.434*	0.015	1.473*
$GROW_t$	+	-0.053	-0.352	-0.017	-1.014
$SIZE_t$	+/–	0.187	1.391*	0.126	0.901
Adj. R^2		0.178		0.156	
F-value		4.505		3.766	

Panel B: RISK ($\sigma_{E,\,t+1}$)

		Regression (3)		Regression (4)	
Variable	Pred. sign	Coefficient	t-value	Coefficient	t-value
Intercept	non	-2.896	-1.673**	-1.597	-1.572*
$RBCR_t$	–	-0.038	-1.722**		
TCR_t	–			-0.026	-1.677**
GAP_t	+	-0.034	-0.426	0.009	0.394
NPL_t	+	0.052	3.873***	0.034	2.670***
$GROW_t$	+	-0.031	-0.970	-0.074	-0.671
$SIZE_t$	+/–	0.016	1.032	0.024	0.854
Adj. R^2		0.201		0.163	
F-value		4.648		4.003	

Asterisks indicate significant at 1% (***), 5% (**), and 10% (*) levels. The t-statistics are based on White's (1980) consistent covariance estimator.

Table 3 Summary Statistics for Predictive Power Comparisons (Vuong Test)

	RISK ($\sigma_{V,\,t+1}$)		RISK ($\sigma_{E,\,t+1}$)	
	Regression (3)	Regression (4)	Regression (3)	Regression (4)
Adj. R^2	0.178	0.156	0.201	0.163
Z-Statistic	3.275***		2.072**	

Asterisks indicate significant at 1% (***), 5% (**), and 10% (*) levels Vuong test using a standard normal distribution.

4.3 Sensitivity Analyses

This study also employs the J_A test (Fisher and McAleer, 1981; Godfrey, 1983) to determine which solvency measure is more associated with subsequent bank risk. The estimation procedures are described in the footnotes of table 4. In panel A, we test whether the equally-risk-weighted capital ratio is a better indicator of solvency to predict subsequent bank risk than the risk-based capital ratio. In the σ_V setting, the evidence indicates that TCR should be rejected in favor of RBCR (the t-statistic for $PRISK^{TCR}$ of –0.719 is insignificant). Next, we test whether the risk-based capital ratio is better than the equally-risk-weighted capital ratio. Results presented in panel B show that TCR should be rejected in favor of RBCR (the t-statistic for $PRISK^{RBCR}$ of 2.353 is significant). In summary, the risk-based capital ratio has more predictive power regarding implied asset risk than the traditional capital ratio. However, the results of the J_A test accepts both capital ratios in the σ_E setting, it indicates that the data are not rich enough to discriminate them.

5. Summary and Conclusions

Risk management forms a main stream of accounting research recently. This study provides evidence on the risk-relevance of the regulatory solvency measures currently used for financial examination purposes. Overall, the empirical results suggest that both capital ratios can predict subsequent bank risk and that the risk-based capital ratio is a more informative indicator of bank solvency than the traditional capital ratio only based on balance sheet.

Table 4 Summary Statistics for Predictive Comparisons (J_A Tests)

Panel A:

	$RESID_{V, t+1}$		$RESID_{E, t+1}$	
Variable	Coefficient	t-value	Coefficient	t-value
Intercept	0.278	2.240**	-0.117	-0.713
RBCR	-0.035	-2.425**	0.085	0.750
$PRISK^{TCR}$	-0.198	-0.719	-1.175	-0.463
Adj. R^2	0.092		0.038	

Panel B:

	$RESID_{V, t+1}$		$RESID_{E, t+1}$	
Variable	Coefficient	t-value	Coefficient	t-value
Intercept	-0.089	-1.155	-0.040	-0.224
TCR	0.088	0.977	0.056	0.252
$PRISK^{RBCR}$	1.245	2.353**	1.708	0.497
Adj. R^2	0.113		0.054	

$RESID_{V, t+1}$ ($RESID_{E, t+1}$) is the residual metric divided from the regression of $\sigma_{V, t+1}$ ($\sigma_{E, t+1}$) on control variables (GAP_t, NPL_t, $GROW_t$, and $SIZE_t$) because the J_A test is most powerful for nonnested hypotheses.

For J_A tests, $PRISK^{RBCR}$ is the predicted risk metric divided from two steps: first, the $RESID_{t+1}$ is regressed on TCR_t to obtain a metric of predicted values; second, the predicted values from the previous regression is regressed on $RBCR_t$ to obtain the predicted metric $PRISK^{RBCR}$. Similarly, $PRISK^{TCR}$ is another predicted risk metric divided from the same steps: first, the $RESID_{t+1}$ is regressed on the $RBCR_t$ to obtain a metric of predicted values; second, the predicted values from the previous regression is regressed on TCR_t to obtain the predicted metric $PRISK^{TCR}$.

Asterisks indicate significant at 1% (***), 5% (**), and 10% (*) levels for J_A tests using t distribution. The t-statistics are based on White's (1980) consistent covariance estimator.

These empirical findings have important implications for bank supervisors and accounting standard setters. As suggested by Scholes (1996), supervisors must take a leading role by proactively consulting with accounting profession in developing a relevant, timely, and dynamic risk-relevant disclosure system. The main function of regulatory filings is to promote safety in banking systems and enhance bank transparency. Besides, public disclosure is an effective complement to supervisory efforts to encourage banks to maintain sound risk management. This study suggests that supervisors treat regulatory information not only to perform the financial examinations entrusted by laws, but also to enrich the information available to detect bank risk-taking behavior. Enhancing transparency can allow market discipline to work earlier and more effectively, thereby strengthening the incentives for banks to operate in an efficient manner. In Taiwan, for instance, Statement of Financial Accounting Standard No. 28 (SFAS 28, 1999) required that all banks must disclose Basel risk-based capital ratio in financial statements since 2000. It represents an initial reconciliation between regulatory accounting principles (RAP) and generally accepted accounting principles (GAAP).

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